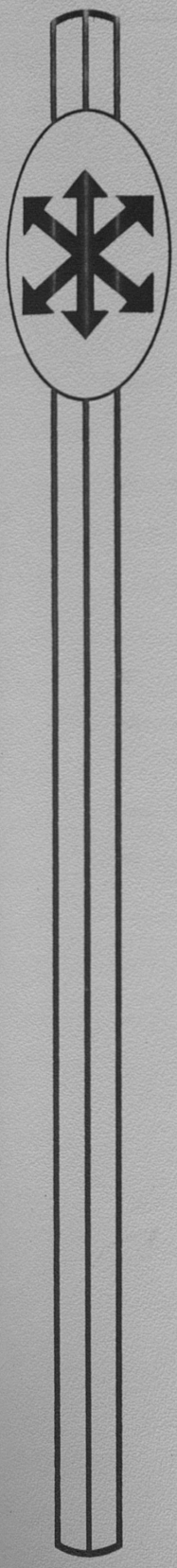

The Potential For Increasing Net Incomes On Limited-Resource Farms In Eastern Kentucky

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THE POTENTIAL FOR INCREASING NET INCOMES ON LIMITED-RESOURCE FARMS IN EASTERN KENTUCKY

by

Fred J. Stewart, Harry H. Hall, and Eldon D. Smith*

INTRODUCTION

Poverty, according to the National Advisory Commission on Rural Poverty, is more prevalent in rural areas of the U.S. than in metropolitan areas. In rural areas, it is more prevalent among farm families than among nonfarm families. The Commission further found that poverty is not uniformly distributed among the rural population but is more concentrated in some areas than in others. Appalachia, including roughly the eastern one-third of Kentucky, was one such area identified by the Commission.

One measure of the extent of rural poverty in eastern Kentucky is given in Table 1. Economic Area 8 (Figure 1), compared with either the rest of Kentucky or the entire U.S., has a much higher proportion of low-income farms.[1]

Farm incomes in Economic Area 8 are low for a variety of reasons. First, farms are small, averaging 114 acres in 1969. Second, much of the land in these farms consists of steep hillsides which are either wooded or badly eroded from past cultivation, providing only marginal amounts of pasture at best. Thus, even if the resources on these farms were used at maximum efficiency, at prevailing prices, the resulting incomes would necessarily be small.

Excluding public assistance, three options for improving incomes are available to farm families in this area: migrate to other areas, seek off-farm employment, or improve income from existing farm resources. Many have already migrated to larger metropolitan areas in search of employment [Brown and Hillery]. Many others, despite chronically high unemployment rates in the area, have sought off-farm employment. Those who have migrated have tended to be younger and better educated than the general population [Lytjes]. Consequently, there is a residual of older, poorly educated farmers whose principal viable option is to use existing farm resources more effectively. In addition, there is evidence that many who have migrated from the area would like to return, even at some sacrifice of income, if they could earn at least a minimal income [Weideman].

Purpose and Objectives

The purpose of this study was to identify any possibilities for improving farm incomes (as distinct from nonfarm incomes) on farms in eastern Kentucky. The major objectives were:

1. To describe the farm operations of full-time Appalachian farm operators who had gross sales less than $5,000 in 1969. This description was to include quantities of land and labor resources, types of farm enterprises, and management skills as reflected by crop yields and animal production.

2. To estimate the potential increases in net farm incomes from given resources. Changes in the enterprise mix or improvements in the technology employed were viewed as two possible sources of such increases.

3. To identify nonresource constraints to the realization of higher incomes and to suggest measures for removing or at least relaxing these constraints.

The Study Area

Four counties in Economic Area 8 -- Jackson, Lee, Owsley, and Wolfe (Figure 1) -- were selected for study. Three circumstances led

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[1]The remainder of Appalachian Kentucky is in Economic Area 9, a coal-mining area with very little agriculture.

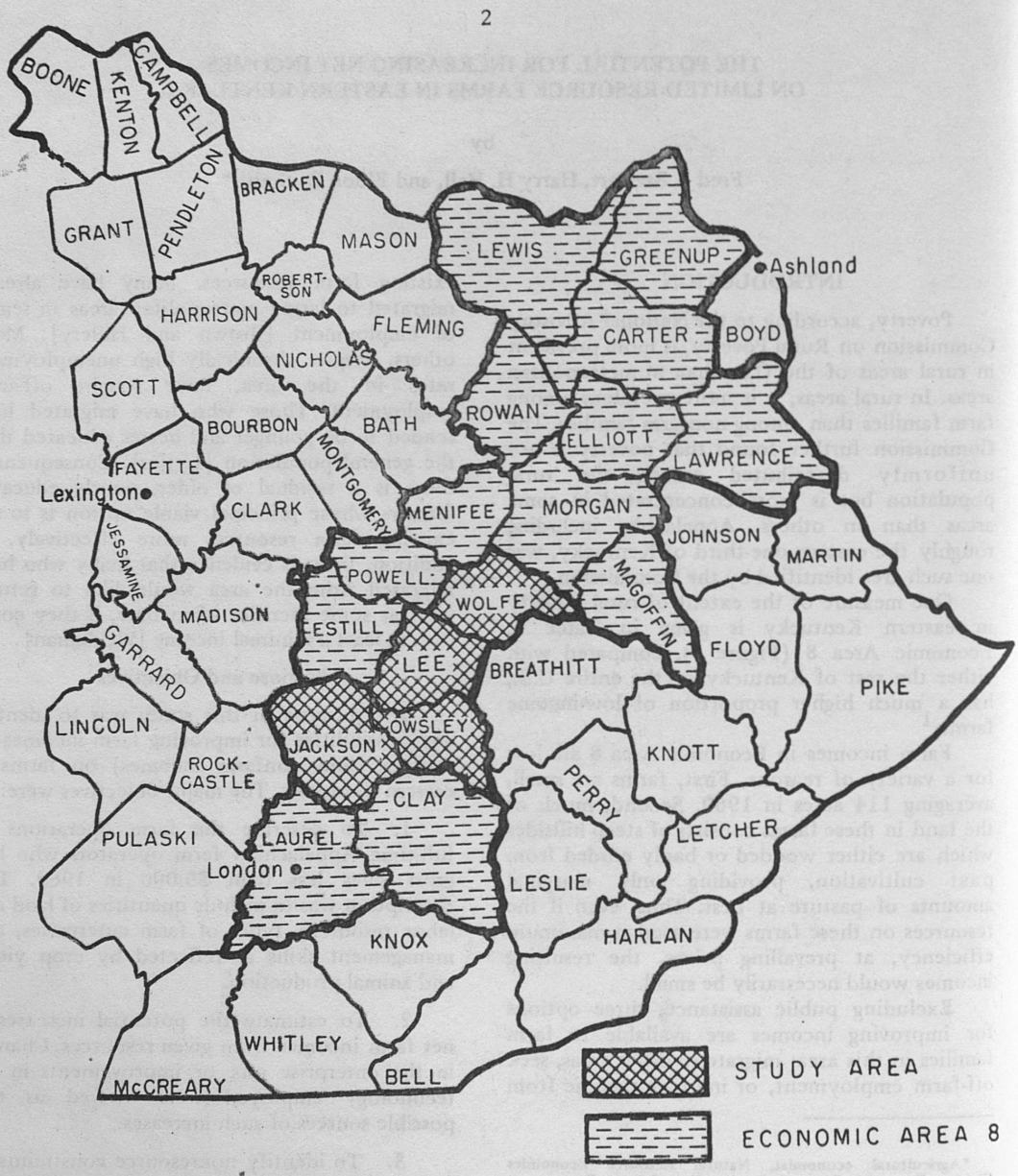

Figure 1.–Economic Area 8 of Kentucky and the Study Counties.

TABLE 1

Proportion of low-income farms in selected areas of the U.S., 1969

Area	Gross Farm Sales Less than $2,500[a]	Gross Farm Sales Less than $5,000[b]
	--------percent--------	
United States	36	51
Kentucky	52	70
Economic Area 8, Kentucky	75	88

[a] Class 6, part-time, and part-retirement farms.

[b] Class 5, Class 6, part-time, and part-retirement farms.

Source: 1969 Census of Agriculture.

TABLE 2

Selected characteristics of the population in Jackson, Lee, Owsley and Wolfe Counties, 1970

	Jackson	Lee	Owsley	Wolfe	Total
Population	10,005	6,587	5,023	5,699	27,314
Rural population (percent)	100	100	100	100	100
Rural farm population (percent)	45	18	43	38	37
Unemployment rate (percent)	13.0	12.9	8.5	7.9	11.1
Families below poverty level[a] (percent)	49.9	48.4	61.6	59.0	53.6
Number of farms	1,225	454	687	631	2,997
Commercial farms[b] with sales under $5,000 (percent)	41	37	45	39	41
Average farm size (acres)	88	84	91	140	99
Farms harvesting 1–9 acres of cropland[c] (percent)	60	69	72	61	64
Average age of farm operator	52.1	55.1	51.0	53.4	52.6

[a] Poverty level is family income under $3,200.

[b] Does not include part-time and part-retirement farms with gross farm sales less than $2,500.

[c] Includes harvested hayland.

Source: *1970 United States Census of Population, 1969 United States Census of Agriculture.*

to this choice: (1) these counties had a high concentration of commercial-farm operators with low gross sales (41% were below $5,000 in 1970), (2) a high proportion of family incomes were below the poverty level (53.6% were below in 1970), and (3) off-farm employment opportunities were very limited, as reflected by the high unemployment rate (11.1% in 1970). These and other characteristics of the four counties are summarized in Table 2.

For purposes of this study, a low-income farmer was defined to be a full-time farm operator under 65 years of age whose gross farm sales in 1972 were less than $5,000. A survey was planned to include 120 low-income farmers in the 4 counties, with the number in each county proportional to the number of farms in classes 5 and 6. Since no list of low-income farmers was available, a two-stage survey was used. In the first stage, the county highway map was divided into segments, each containing 10 farms. Within randomly selected segments, then, every farm operator was interviewed to determine whether he was a low-income farmer. This process continued until the required number of low-income farmers was found. In this first stage, 40 segments were selected and 379 farmers were interviewed before 120 low-income farmers were identified.

In the second stage, a more detailed questionnaire was administered to the 120 low-income farmers identified in the first stage. Of the 120 interviews conducted in stage 2, 102 resulted in usable questionnaires, and these provided the principal data source for the results reported in the remainder of this report. Both questionnaires are available in Stewart (1975).

SURVEY RESULTS

Among the 102 farms surveyed, the average education of the operator was 6.5 years. The average operator owned 81 acres of farmland and rented an additional 24 acres. Of this 105 acres of land, roughly 69 acres (65%) was woodland. These farms had very few livestock. Most of the farm income was derived from crops, tobacco being the most important cash crop. These and other characteristics of the 102 farms surveyed are summarized in Table 3.

In reviewing the survey results, two types of farms emerged: those that used mainly tractors for draft power and those that used mainly animals (mules). The tractors used were, for the most part, small (28.3 avg. HP) and old (avg. 11 years). Nonetheless, they required less time than mules for most field operations. Consequently, the farms surveyed were classified into one of two groups--tractor-power farms or animal-power farms--depending on the primary source of draft power.

The survey results by type of farm are summarized in Table 3 along with the overall results. Animal-power farms were smaller, on the average, than tractor-power farms (89 total acres vs. 127). Agricultural production on animal-power farms, measured in either quantity or value, was smaller than on tractor-power farms. Operators of animal-power farms were older, had higher disability rates, and had fewer children. Consequently, the family labor supply was smaller than on tractor-power farms. Thus, animal-power farms have smaller amounts of both land and labor, and many of their field operations require more time.

In the subsequent analysis, animal-power farms and tractor-power farms were treated separately. For crop enterprises, animal-power farms were assumed to require more labor and less capital per unit of enterprise than tractor-power farms. Some crop yields on animal-power farms, according to the survey results, were also lower. Since the data showed no appreciable differences between the two farms in livestock enterprises, they are assumed to be the same for both classes of farms.

ANALYTICAL RESULTS

For each set of farms (animal-power and tractor-power), a typical or representative farm was defined, and its options were analyzed by linear programming. The animal-power farm had less land, less family labor, and less tobacco base; but it was permitted the same amounts of hired labor (see Appendix Tables 1–4).

Two levels of technology -- existing and improved -- were considered in the analysis. Existing technology consists of yields, physical inputs, and requirements for capital and labor observed in the survey. Under existing technology, crop yields on the animal-power farm, for example, are the arithmetic means of crop yields for all farms classified as animal-power farms. Improved technology consists of practices and input requirements based on estimates and recommendations of University of Kentucky Cooperative Extension Specialists [e.g., Allen and Browning]. Assumed yields for both technologies are reported in

TABLE 3

Characteristics of sample farms and farm operators by source of draft power

	All Farms	Tractor-Power Farms	Animal-Power Farms
Number of Farms	102	43	59
Operator Characteristics			
Average Age (years)	47.2	44.2	49.2
Average Education (years)	6.5	7.4	5.7
Percent Able-bodied Man Equivalent Work Capability	81	85	79
Available Family Labor (full-time)			
Man equivalents (hours/week)			
June-August	62.8	67.5	59.4
Fall and Winter	52.6	53.2	52.2
Land Resources (acres)			
Owned	81.0	83.0	79.5
Rented-In[a]	24.0	44.0	9.4
Total	105.0	127.0	88.9
Land Classification, Owned and Rented (acres)			
Bottomland	4.1	4.1	4.1
Rotation land	5.5	9.3	2.7
Pasture land	12.9	18.5	8.8
Hayland	5.2	6.6	4.1
Woodland	68.7	75.2	64.0
Other	8.6	13.3	5.2
Total	105.0	127.0	88.9
Tobacco			
Owned Quota (pounds)	1,516.0	1,772.0	1,329.0
Share-leased Quota (pounds)	1,455.0	1,941.0	1,100.0
Cwt. 5-10-5 Fertilizer Per Acre	24.4	23.1	25.3
Gallons MH-30 Per Acre	1.5	1.4	1.6
Dairy and Beef Income per Year (dollars)	1,056	1,483	703

[a]Excludes tobacco grown on shares.

TABLE 4

Crop and livestock yields for animal-power and tractor-power farms under existing and improved technology

Enterprise	Animal-Power		Tractor-Power	
	Existing Technology	Improved Technology	Existing Technology	Improved Technology
Crops (yields per acre)				
Tobacco on bottom land (pounds)	2,215	2,800	2,215	2,800
Tobacco on rotation land (pounds)	2,159	2,500	2,159	2,500
Corn on bottom land (bushel)	56.6	90.0	64.9	90.0
Corn on rotation land (bushel)	56.6	81.0	64.9	81.0
Hay on rotation or pasture land (tons)	2.2	2.5	2.1	2.5
Pasture (tons hay equivalent)	2.0	2.0	2.0	2.0
Cucumbers (bushel)	277	400	277	400
Peppers (tons)	5.5	8.0	5.5	8.0
Livestock				
Dairy cow (pounds milk/cow)	5,900	10,000	5,900	10,000
Cow-feeder calf (pounds feeder calf/cow)	350	360	350	360
Sow-feeder pigs (pigs/litter)	5.2	7.2	5.2	7.2

Table 4. Although some yields were the same on both farms, inputs were not necessarily the same. Even under improved technology, for example, the animal-power farm was assumed to use mules for draft-power and, consequently, it had higher labor requirements in many enterprises [see Appendix Tables 1–4].

To estimate yields under existing technology for enterprises not observed in the survey was impossible, of course. Moreover, there was no way to determine how readily, or even if, farmers would adopt new, unfamiliar enterprises. Finally, there was no established market for the output of enterprises not observed in the survey. Consequently, only enterprises observed in the survey were considered in the analysis.

A complete list of the activities considered is contained in Appendix Tables 1–4. In addition to production activities (crop and livestock), the following activities were allowed in one or more of the subsequent analyses:

1. Buy or sell corn.
2. Buy or sell hay.
3. Borrow capital.
4. Hire labor.
5. Lease-in tobacco allotment.
6. Build tobacco curing-barn space.
7. Share-lease tobacco.

Three types of capital were defined: operating capital, animal capital (for buying breeding animals), and building capital (for adding curing-barn space, hog houses, or milking parlors).[2] All pasture requirements were assumed to be supplied from owned land resources.

The effects of factors other than technology were also analyzed. For example, the effects of limitations on the amount of capital borrowed, of changes in the regulations governing the use of tobacco allotments, and of eliminating tobacco production entirely were considered.

Unrestricted Capital Borrowing

This section examines the effects of unrestricted capital use with the given land, labor, and other resources. Each farm is permitted to borrow any amount of capital, subject only to a 7% interest charge. The only restriction on the use of this capital is that the option of building additional curing-barn space is not allowed. That is, no more tobacco may be grown on owned land than can be stored in existing barn space. (Curing-barn space for share-leased tobacco is assumed to be provided with the lease.) Borrowed capital may not be used to buy more land, of course, and all pasture requirements must be supplied from owned land. The lease price for tobacco allotment is assumed to be 20 cents per pound.

Results for the tractor-power farm are given in Table 5 and those for the animal-power farm in Table 6.[3] According to these results, the tractor-power farm could increase its net income $1,900 with no change in technology, by growing more profitable crops and by substituting dairy cows for beef cows. Similar changes in enterprises on the animal-power farm would increase net income by $1,865. In both cases, changes in crop enterprises include increases in the quantities of tobacco, cucumbers, and peppers. The increases in tobacco production require leasing-in sufficient tobacco allotment to fill curing-barn space.

Adopting improved technology as well as more profitable enterprises increases net incomes an additional $2,009 on the tractor-power farm and $1,762 on the animal-power farm. Only minor additional changes in crop enterprises are indicated, but feeder pigs replace dairy cows. Under assumed prices, most of the corn required for the pigs is purchased rather than grown on the farms. The maximum net income on the animal-power farm is lower than that on the tractor-power farm ($5,248 vs. $6,571) largely because the animal-power farm has less land.

Many of the enterprise changes require increasing the amounts of labor-intensive enterprises, thus increasing the labor requirements. Moreover, despite the apparent gain from leasing-in tobacco allotment, very little was reported in the survey. Similarly, the optimal acreages of cucumbers and peppers are substantially larger than those observed in the survey. Finally, capital requirements increase dramatically when feeder pigs are added as an

[2] Investment in existing buildings was viewed as "sunk costs" with negligible salvage value.

[3] The various computer runs are identified by symbol. T-1E, for example, is the first run with the tractor-power farm using existing technology. Descriptive headings for the same run differ from table to table depending on the contrasting conditions being analyzed. The symbol designation (e.g. T-1E) uniformly appears in the heading irrespective of the descriptive heading.

TABLE 5

Optimal enterprise combinations and net incomes for the tractor-power farm with unrestricted capital

	Observed Enterprises	Existing Technology, Optimal (T-1E)	Improved Technology, Optimal (T-1I)
Net Income	$2,662	$4,562	$ 6,571
Crops (acres)			
Tobacco on bottom land	0.8	1.0	0.8
Tobacco on shares	0.9	0.9	0.8
Corn on bottom land	3.1	0	0
Cucumbers on bottom land	0.1	2.0	1.5
Peppers on bottom land	0.2	1.1	1.8
Peppers on rotation land	0	2.6	2.0
Hay on rotation land	0	4.2	5.4
Hay on pasture land	9.2	9.4	9.6
Livestock			
Dairy cows (manufactured milk)	0	6.1	0
Beef cows (sell feeder calves)	3.8	0	0
Sows (producing feeder pigs)	0.5	0	44.0
Other Enterprises			
Sell hay (tons)	6.5	12.9	37.3
Buy corn (bushels)	0	0	1,910
Sell corn (bushels)	119	0	0
Hire August labor (hours)	55	100	100
Hire October-December labor (hours)	0	0	45
Lease-in tobacco allotment (pounds)	0	443	443
Capital Requirements			
Operating capital	$ 745	$1,394	$ 4,276
Animal capital	616	1,145	4,088
Building capital	0	609	9,020
Total capital	$1,361	$3,148	$17,384

TABLE 6

Optimal enterprise combinations and net incomes for the animal-power farm with unrestricted capital

	Observed Enterprises	Existing Technology, Optimal (A-1E)	Improved Technology, Optimal (A-1I)
Net Income	$1,621	$3,486	$ 5,248
Crops (acres)			
Tobacco on bottom land	0.8	0	0.6
Tobacco on rotation land	0	0.8	0
Tobacco on shares	0.7	0.6	0.5
Corn on bottom land	2.2	0	0
Cucumbers on bottom land	0	1.7	1.3
Peppers on bottom land	0.1	2.4	2.2
Peppers on rotation land	0	0.6	0.6
Hay on rotation land	0	0.6	1.5
Hay on pasture land	7.8	0.2	0
Livestock			
Dairy cows (manufactured milk)	0	5.7	0
Beef cows (sell feeder calves)	1.8	0	0
Sows (producing feeder pigs)	0.2	0	44.0
Other Enterprises			
Buy hay (tons)	0	12.6	0
Sell hay (tons)	0	0	3.8
Buy corn (bushels)	0	0	1,892
Sell corn (bushels)	118	0	0
Hire April-May labor (hours)	0	0	22
Hire August labor (hours)	55	100	10
Lease-in tobacco allotment (pounds)	0	332	332
Capital Requirements			
Operating capital	$ 486	$ 903	$ 3,368
Animal capital	288	1,073	4,048
Building capital	0	570	8,932
Total capital	$ 774	$2,546	$16,348

enterprise. Whether farmers are willing to make these kinds of changes is an unanswered question. For capital, ability to borrow may be more of a limitation than willingness, and the next section examines the effects of restricting the amounts of capital borrowed.

Restricted Capital Borrowing

In this part of the analysis, borrowing a unit of either operating capital, animal capital, or building capital requires, in addition, a unit of "total capital." Limits on the quantity of total capital were increased in increments of $1,000 up to the point that the increase in net income was less than $100. That point was $3,000 for the tractor-power farm, $2,000 for the animal-power farm.

An interest charge of 7% was made on any capital borrowed, as described in the previous section. Once again, neither adding curing-barn space nor buying more land was allowed, all pasture requirements had to be supplied from owned land, and the lease price for tobacco allotment was assumed to be 20 cents per pound.

Existing Technology

Table 7 reports results for the tractor-power farm and Table 8 those for the animal-power farm. Both farms again emphasize tobacco, cucumbers, and peppers, just as they did when the amounts of borrowed capital were unlimited. Both farms reduce the number of dairy cows, however, and since pasture requirements are reduced accordingly, both increase the quantity of hay harvested (and sold) from pasture land. On the tractor-power farm, if as much as $3,000 can be borrowed, net income is reduced negligibly (less than 1%). If no more than $1,000 can be borrowed, however, dairy cows disappear completely and net income is reduced more severely. Net income on the animal-power farm is virtually unaffected by limitations of either $1,000 or $2,000 on borrowed capital.

Improved Technology

Table 9 reports the results for the tractor-power farm and Table 10 those for the animal-power farm. With improved technology, limitations on capital borrowing affect enterprise combinations in much the same way as with existing technology. Both farms still emphasize crops – tobacco, cucumbers, and peppers – and reduce the number of livestock (feeder pigs).

Net incomes, however, are affected more severely than with existing technology. On the tractor-power farm, if no more than $3,000 of capital can be borrowed, net income is reduced by nearly 6% (from $6,571 to $6,206); if no more than $1,000 can be borrowed, net income is reduced by more than 16% (from $6,571 to $5,493). On the animal-power farm, if no more than $2,000 can be borrowed, net income is reduced by nearly 10% (from $5,248 to $4,762); if no more than $1,000 can be borrowed, net income is reduced by more than 13% (from $5,248 to $4,562). These income effects are due largely to decreases in the numbers of feeder pigs, which are much more profitable under improved technology than under existing technology.

Unrestricted Tobacco Allotment Leasing

Leasing of burley tobacco allotments has been permitted since 1971, when allotment allocations were changed from acreage to poundage. Such leases may not exceed 5 years, and the lessee and lessor must reside in the same county. If this within-county restriction were removed, some allotments *might* move from counties where labor is scarce and relatively expensive (e.g., counties in the Bluegrass area) to counties where labor is frequently in excess supply and, therefore, less expensive (e.g., counties in Appalachia).

In this part of the analysis, unlimited capital borrowing is permitted once again, subject only to a 7% interest charge. For any allotment leased beyond what can be accommodated in existing curing-barn space, additional barn space must be constructed. Borrowed capital may be used for that purpose, but it cannot be used to buy land. All pasture requirements must be supplied from owned land, and the lease price for tobacco allotment is assumed to be 20 cents per pound.

The charge for additional curing-barn space is the annual amortized cost, assuming a 40 year life for the barn. In reality, such an investment would probably not be made unless a lease of more than 5 years' duration could be assured. No explicit assumption is made about where long term leases would be obtained. An implicit assumption, however, is that, if they are not available locally (within the county), they can be obtained from other counties. In reality, once again, allotments could be obtained from other counties only if present allotment restrictions

TABLE 7

Optimal enterprise combinations and net incomes for the tractor-power farm using existing technology and restricted amounts of capital

	Unlimited Capital (T-1E)	$1,000 Capital (T-2E)	$3,000 Capital (T-3E)
Net Income	$4,562	$3,944	$4,542
Crops (acres)			
Tobacco on bottom land	1.0	1.0	1.0
Tobacco on shares	0.9	0.9	0.9
Cucumbers on bottom land	2.0	2.6	2.0
Peppers on bottom land	1.1	0.5	1.1
Peppers on rotation land	2.6	3.1	2.7
Hay on rotation land	4.2	3.1	4.0
Hay on pasture land	9.4	4.7	10.2
Livestock			
Dairy cows (manufactured milk)	6.1	0	5.5
Other Enterprises			
Sell hay (tons)	12.9	16.3	15.6
Hire August labor (hours)	100	100	100
Lease-in tobacco allotment (pounds)	443	443	443
Capital Requirements			
Operating capital	$1,394	$1,000	$1,402
Animal capital	1,145	0	1,043
Building capital	609	0	555
Total capital	$3,148	$1,000	$3,000

TABLE 8

Optimal enterprise combinations and net incomes for the animal-power farm using existing technology and restricted amounts of capital

	Unlimited Capital (A-1E)	$1,000 Capital (A-2E)	$2,000 Capital (A-3E)
Net Income	$3,486	$3,430	$3,474
Crops (acres)			
Tobacco on rotation land	0.8	0.8	0.8
Tobacco on shares	0.6	0.6	0.6
Cucumbers on bottom land	1.7	1.4	1.2
Cucumbers on rotation land	0	0.6	0.6
Peppers on bottom land	2.4	2.7	2.9
Peppers on rotation land	0.6	0	0
Hay on rotation land	0.6	0.6	0.6
Hay on pasture land	0.2	7.0	2.3
Livestock			
Dairy cows (manufactured milk)	5.7	1.2	4.3
Other Enterprises			
Buy hay (tons)	12.6	0	4.4
Sell hay (tons)	0	13.8	0
Hire August labor (hours)	100	48	86
Lease-in tobacco allotment (pounds)	332	332	332
Capital Requirements			
Operating capital	$ 903	$ 657	$ 759
Animal capital	1,073	224	810
Building capital	570	119	431
Total capital	$2,546	$1,000	$2,000

TABLE 9

Optimal enterprise combinations and net income for the tractor-power farm using improved technology and restricted amounts of capital

	Unlimited Capital (T-11)	$1,000 Capital (T-21)	$3,000 Capital (T-31)
Net Income	$ 6,571	$5,493	$6,206
Crops (acres)			
Tobacco on bottom land	0.8	0.6	0.3
Tobacco on rotation land	0	0.2	0.5
Tobacco on shares	0.8	0.8	0.8
Cucumbers on bottom land	1.5	2.8	2.2
Peppers on bottom land	1.8	0.7	1.6
Peppers on rotation land	2.0	3.0	2.9
Hay on rotation land	5.4	3.0	2.9
Hay on pasture land	9.6	3.9	17.5
Livestock			
Dairy cows (manufactured milk)	0	0	0.5
Sows (producing feeder pigs)	44.0	0	5
Other Enterprises			
Sell hay (tons)	37.3	17.0	49.0
Buy corn (bushels)	1,910	0	215
Hire August labor (hours)	100	100	100
Hire October-December labor (hours)	45	0	0
Lease-in tobacco allotment (pounds)	443	443	443
Capital Requirements			
Operating capital	$ 4,276	$1,000	$2,016
Animal capital	4,088	0	680
Building capital	9,020	0	304
Total capital	$17,384	$1,000	$3,000

TABLE 10

Optimal enterprise combinations and net incomes for the animal-power farm using improved technology and restricted amounts of capital

	Unlimited Capital (A-11)	$1,000 Capital (A-21)	$2,000 Capital (A-31)
Net Income	$ 5,248	$4,562	$4,762
Crops (acres)			
Tobacco on bottom land	0.6	0	0
Tobacco on rotation land	0	0.7	0.7
Tobacco on shares	0.5	0.5	0.5
Cucumbers on bottom land	1.3	2.0	1.9
Peppers on bottom land	2.2	2.1	2.2
Peppers on rotation land	0.6	0.6	0.6
Hay on rotation land	1.5	0.6	0.6
Hay on pasture land	0	8.5	7.6
Livestock			
Sows (producing feeder pigs)	44.0	1.5	5.8
Other Enterprises			
Sell hay (tons)	3.8	22.7	20.5
Buy corn (bushels)	1,892	64	250
Hire April-May labor (hours)	22	0	0
Hire August labor (hours)	10	30	40
Lease-in tobacco allotment (pounds)	332	332	332
Capital Requirements			
Operating capital	$ 3,368	$ 788	$1,051
Animal capital	4,048	138	535
Building capital	8,932	74	414
Total capital	$16,348	$1,000	$2,000

were modified. In both cases (length of lease and area of lease), the intent of the analysis is to argue neither for nor against modifications in the allotment program, but to show some possible consequences of such modifications.

Tractor-power Farm

Table 11 shows the effects on the tractor-power farm of unrestricted allotment leasing. Under existing technology, additional allotment is leased until the supply of tobacco-harvesting labor (October–December), including hired labor, is exhausted. No tobacco is share leased, dairy cows are eliminated, and the acreages of cucumbers and peppers are reduced. Since there are no dairy cows, the pasture land is harvested for hay, which is sold. As the result of all these enterprise changes, net income increases by roughly 20% (from $4,562 to $5,497).

Under improved technology, allotment is leased (cash and share) until the supply of tobacco-harvesting labor, including hired labor, is exhausted. The amount of share-leased tobacco is less than when allotment leasing is limited, the acreages of cucumbers and peppers are reduced, and the number of sows is reduced. Reducing the number of sows reduces the requirements for pasture, and the unused pasture land is harvested for hay which is sold. Consequently, net income is increased by nearly 14% (from $6,571 to $7,482).

Leasing tobacco allotment and building the attendant curing-barn space increases capital requirements. Thus, if capital borrowing is restricted, the amount of tobacco allotment leased is restricted accordingly. If the tractor-power farm can borrow no more than $3,000 of capital, for example, livestock are eliminated entirely and tobacco production is expanded until the limited capital supply is exhausted. Additional results for limited capital, but unlimited tobacco allotment leasing, are available in Stewart (1975).

Animal-power Farm

The effects on the animal-power farm of unrestricted allotment leasing are given in Table 12. Enterprise combinations change in much the same way as those on the tractor-power farm. Under existing technology, net income increases by roughly 39% (from $3,486 to $4,839), and under improved technology, by 21% (from $5,248 to $6,356). The effects on the animal-power farm of restricting capital borrowing are also similar to those on the tractor-power farm and for the same reasons. Again, further details on restricting capital borrowing are available in Stewart (1975).

Allotment Lease Price

Relatively small increases in allotment lease prices change the optimal solutions for both farms, but the associated changes in amounts of tobacco are also relatively small. Table 13 shows the minimum increase in lease price that would change the optimal solution and gives the associated change in the amount of tobacco. Changes in the amounts of tobacco are much smaller under improved technology than under existing technology.

Eliminating Tobacco Production

All the preceding results indicate that tobacco production is an important means to improving the incomes of small farms in eastern Kentucky. If within–county restrictions on tobacco allotment leasing are removed, however, allotments may tend to move to large-scale farms, rather than to small-scale farms, as assumed in the previous section. This might be especially true if, for example, a mechanical tobacco harvester is perfected. In bidding for allotments, farms with large allotments may then gain a substantial comparative advantage over farms with small allotments. Thus, this section examines changes in enterprise combinations and incomes when tobacco production is not an admissible enterprise at all.

It is assumed, first, that any owned tobacco allotment is leased out at 20 cents per pound and that no tobacco is share-leased. The leased value of the owned allotments – $354 on the tractor-power farm – is included in the estimates of net income. Further, limited amounts of capital may be borrowed (up to $3,000 by the tractor-power farm, up to $2,000 by the animal-power farm) at 7% interest. Finally, all pasture requirements must be supplied from owned land; that is, land expansion by either buying or renting is not permitted.

Table 14 reports the results for the tractor-power farm. When tobacco production is eliminated, the acreages of cucumbers and peppers increase. In addition, under existing technology, the number of dairy cows increases,

TABLE 11

Optimal enterprise combinations and net incomes for the tractor-power farm, restricted vs. unrestricted leasing-in of tobacco allotments

	Existing Technology		Improved Technology	
	Restricted Leasing-In (T-1E)	Unrestricted Leasing-In (T-4E)	Restricted Leasing-In (T-1I)	Unrestricted Leasing-In (T-4I)
Net Income	$4,562	$5,497	$ 6,571	$7,482
Crops (acres)				
Tobacco on bottom land	1.0	3.4	0.8	3.9
Tobacco on rotation land	0	1.5	0	0
Tobacco on shares	0.9	0	0.8	0.7
Cucumbers on bottom land	2.0	0.7	1.5	0.2
Cucumbers on rotation land	0	0.6	0	1.1
Peppers on bottom land	1.1	0	1.8	0
Peppers on rotation land	2.6	1.9	2.0	2.0
Hay on rotation land	4.2	2.4	5.4	3.1
Hay on pasture land	9.4	18.5	9.6	17.5
Livestock				
Dairy cows (manufactured milk)	6.1	0	0	0
Sows (producing feeder pigs)	0	0	44.0	5.0
Other Enterprises				
Sell hay (tons)	12.9	43.5	37.3	51.2
Buy corn (bushel)	0	0	1,910	215
Hire August labor (hours)	100	100	100	100
Hire October-December labor (hours)	0	160	45	160
Lease-in tobacco allotment (pound)	443	8,998	443	9,249
Capital Requirements				
Operating capital	$1,394	$3,756	$ 4,276	$4,309
Animal capital	1,145	0	4,088	460
Building capital	609	4,278	9,020	4,653
Total capital	$3,148	$8,034	$17,384	$9,422

TABLE 12

Optimal enterprise combinations and net incomes for the animal-power farm, restricted vs. unrestricted leasing-in of tobacco allotments

	Existing Technology		Improved Technology	
	Restricted Leasing-In (A-1E)	Unrestricted Leasing-In (A-4E)	Restricted Leasing-In (A-1I)	Unrestricted Leasing-In (A-4I)
Net Income	$3,486	$4,839	$ 5,248	$6,356
Crops (acres)				
Tobacco on bottom land	0	2.5	0.6	3.0
Tobacco on rotation land	0.8	2.0	0	1.1
Tobacco on shares	0.6	0.4	0.5	0.5
Cucumbers on bottom land	1.7	0.9	1.3	0.9
Peppers on bottom land	2.4	0.7	2.2	0.2
Peppers on rotation land	0.6	0	0.6	0.4
Hay on rotation land	0.6	0	1.5	0.4
Hay on pasture land	0.2	8.8	0	7.8
Livestock				
Dairy cows (manufactured milk)	5.7	0	0	0
Sows (producing feeder pigs)	0	0	44.0	5.0
Other Enterprises				
Sell hay (tons)	0	19.6	3.8	20.5
Buy hay (tons)	12.2	0	0	0
Buy corn (bushels)	0	0	1,892	215
Hire April-May labor (hours)	0	0	22	0
Hire August labor (hours)	100	73	10	69
Hire October-December labor (hours)	0	160	0	160
Lease-in tobacco allotment (pounds)	332	8,584	332	9,892
Capital Requirements				
Operating capital	$ 903	$2,942	$ 3,368	$3,570
Animal capital	1,073	0	4,048	460
Building capital	570	4,126	8,932	5,030
Total capital	**$2,546**	**$7,068**	**$16,348**	**$9,060**

TABLE 13

Changes in tobacco allotment lease price required to change the optimal enterprise combination and the associated change in production

	Change in Tobacco Lease Price	Change in Tobacco Production
Tractor-Power Farm:		
Existing Technology	+ 8%	- 20%
Improved Technology	+18%	-0.1%
Animal-Power Farm:		
Existing Technology	+ 4%	- 6%
Improved Technology	+30%	- 4%

TABLE 14

Optimal enterprise combinations and net incomes for the tractor-power farm limited to $3,000 of total capital, restricted leasing-in of tobacco allotments and no leasing-in

	Existing Technology		Improved Technology	
	Restricted Leasing-In (T-3E)	No Leasing-In (T-6E)	Restricted Leasing-In (T-31)	No Leasing-In (T-61)
Net Income	$4,542	$3,544	$6,206	$5,128
Crops (acres)				
Tobacco on bottom land	1.0	0	0.3	0
Tobacco on rotation land	0	0	0.5	0
Tobacco on shares	0.9	0	0.8	0
Cucumbers on bottom land	2.0	0	2.2	2.8
Cucumbers on rotation land	0	2.6	0	0
Peppers on bottom land	1.1	4.1	1.6	1.3
Peppers on rotation land	2.7	0.5	2.9	3.1
Hay on rotation land	4.0	3.1	2.9	3.1
Hay on pasture land	10.2	8.6	17.5	17.1
Livestock				
Dairy cows (manufactured milk)	5.5	6.6	0.5	0
Sows (producing feeder pigs)	0	0	5.0	6.8
Other Enterprises				
Buy corn (bushels)	0	0	215	292
Sell hay (tons)	15.6	7.8	49.0	50.3
Hire August labor (hours)	100	86	100	53
Lease-in tobacco allotment (pounds)	443	0	443	0
Capital Requirements				
Operating capital	$1,402	$1,097	$2,016	$1,760
Animal capital	1,043	1,242	680	625
Building capital	555	661	304	615
Total capital	$3,000	$3,000	$3,000	$3,000

TABLE 15

Optimal enterprise combinations and net incomes for the animal-power farm limited to $2,000 of total capital, restricted leasing-in of tobacco allotments and no leasing-in

	Existing Technology		Improved Technology	
	Restricted Leasing-In (A-3E)	No Leasing-In (A-6E)	Restricted Leasing-In (A-3I)	No Leasing-In (A-6I)
Net Income	$3,474	$2,645	$4,762	$3,950
Crops (acres)				
Tobacco on rotation land	0.8	0	0.7	0
Tobacco on shares	0.6	0	0.5	0
Cucumbers on bottom land	1.2	1.3	1.9	2.3
Cucumbers on rotation land	0.6	0.9	0	0
Peppers on bottom land	2.9	2.8	2.2	1.8
Peppers on rotation land	0	0	0.6	0.9
Hay on rotation land	0.6	0.9	0.6	0.9
Hay on pasture land	2.3	1.3	7.6	7.5
Livestock				
Dairy cows (manufactured milk)	4.3	5.0	0	0
Sows (producing feeder pigs)	0	0	5.8	6.4
Other Enterprises				
Buy corn (bushels)	0	0	250	277
Buy hay (tons)	4.4	7.6	0	0
Sell hay (tons)	0	0	20.5	20.9
Hire August labor (hours)	86	46	40	0
Lease-in tobacco allotment (pounds)	332	0	332	0
Capital Requirements				
Operating capital	$ 759	$ 566	$1,051	$ 865
Animal capital	810	936	535	593
Building capital	431	498	414	542
Total capital	$2,000	$2,000	$2,000	$2,000

and under improved technology the number of sows increases. Net income decreases, by nearly 21% (from $4,542 to $3,544) under existing technology and by more than 17% (from $6,206 to $5,123) under improved technology.

Results for the animal-power farm are given in Table 15. Enterprise combinations change in exactly the same way as for the tractor-power farm. The changes in net income, although smaller in absolute amount, are even larger percentage changes. Net income decreases by nearly 24% (from $3,474 to $2,645) under existing technology and by 17% (from $4,762 to $3,950) under improved technology.

These results emphasize the importance of tobacco to low-income farms in eastern Kentucky. Other labor intensive crops such as cucumbers and peppers can substitute for tobacco to some extent, but they are substantially less profitable. Moreover, they entail more risk in that their production technologies are not as widely nor as well known, their markets are not as well established, and their prices are much more subject to wide fluctuations since they are not controlled.

POLICY IMPLICATIONS

The results of this study show that low-income farmers in eastern Kentucky can increase their incomes. Even under the existing tobacco program, the animal-power farm, for example, could more than double its net income (from $1,621 to $3,486) by using more profitable enterprises, and could increase it an additional 50% (from $3,486 to $5,248) by adopting improved technology (Table 6). On the tractor-power farm, more profitable enterprises alone would increase net income by 70% (from $2,662 to $4,562) and improved technology would increase it another 44% (from $4,562 to $6,571) (Table 5). If the tobacco program is altered so that these farms can grow more tobacco, incomes can be increased even more. (On the other hand, if alterations in the tobacco program ultimately force these farms to produce less tobacco, the possible income gains are smaller.)

By some standards, even the largest of these incomes is still low. The median family income in Kentucky in 1969, for example, was $7,439. But all of the potential incomes represent substantial improvements over present incomes. Why are low-income farmers not making changes that would help them realize these larger incomes? Is it reluctance to change established patterns, lack of information about the alternatives, or other factors? Some further survey results partially answer these questions. Each operator in the survey was asked: "If you were to expand your farming operation, which of the following enterprises would interest you and how interested would you be?" For each enterprise, one of three responses was possible: no interest, some interest, and very interested. To summarize these results, "no interest" was scored zero, "some interest" was scored 1, and "very interested" was scored 2. Average scores are given in Table 16.

Beef cows scored higher than either feeder pigs, dairy cows, or leasing additional tobacco allotment, although beef cows entered none of the programming solutions. In the survey, operators were not told the relative profitability of the various enterprises, and they may not have known. It may also be, however, that many operators have an aversion to certain enterprises — dairy cows for example. In either case, some effort by public educational organizations may be required to inform these farmers of the profitability of various enterprises and to make available the information required to use those enterprises.

Educational Programs

It is possible, from the results of this study, to estimate the potential benefit to this group of farmers of changing their farming operations. It is not possible, however, to estimate either the public costs of educational programs to bring about the required changes in enterprises and technology or the public welfare savings that would result. Such costs and savings can probably be estimated only by conducting a pilot program among these farmers and collecting information on the welfare costs of the families affected both before and after the program is implemented. If such a program, or for that matter any other educational program among these farmers, is to have any hope of success, some further findings of the study must be considered:

1. The average age of the farmers interviewed in this study was 47 years (Table 3). Some were approaching normal retirement age. For those of advanced age the expected period of benefits received from investments associated with new enterprise combinations may be so short that discounted future benefits may be less

TABLE 16

Preferences of low income farmers for five enterprises

Enterprise	Mean Preference Score[a]
Vegetables	1.08
Cow-feeder calves	1.01
Lease additional tobacco allotment	0.84
Sow-feeder pigs	0.73
Dairy	0.11

[a] 0 = no interest, 1 = some interest, and 2 = very interested.

than costs.

2. The average education of the operators interviewed was 6.5 years. Many of the operators probably have difficulty reading or doing simple arithmetic.

3. Much of the population that is the subject of this study is not reached by established educational organizations. In the year preceding the survey, for example, only 12% of the operators surveyed reported having contacted the county agricultural extension agent. Most of those contacts concerned a single problem – pepper blight.

4. The technology used in producing tobacco is similar to that used elsewhere in Kentucky. For other enterprises, however, the level of technology is low. Only 15% of the operators, for example, used soil tests in the year preceding the survey, and 51% of those who grew corn used open-pollinated rather than hybrid seed.

5. Some changes in enterprises and technology cannot be fully exploited without additional capital. Thus, if educational programs are to be effective, they may have to be accompanied by programs to supply additional capital.

The Tobacco Allotment Program

This study shows that limited resource farms in eastern Kentucky would benefit from leasing additional tobacco allotment. Some allotments in the area have not been used and, presumably, could be made available to these farmers at some price. If, for whatever reason, these unused allotments are not made available for lease, eliminating restrictions on inter-county allotment leasing appears to be the only potential source of additional allotment. It is not possible to infer, from the results of this study, whether eliminating restrictions on inter-county leasing would increase or decrease the quantity of allotments available to farmers in eastern Kentucky. Smith found that it is sometimes more profitable for beef cattle farms to lease-out their tobacco allotments rather than grow it themselves. That study did not show, however, where such allotments would tend to move. This aspect of the allotment leasing program needs further analysis.

SUMMARY AND CONCLUSIONS

This study was designed to identify possibilities for improving farm incomes on low-income, full-time farms in eastern Kentucky without expanding the land base. For purposes of the study, a low-income farmer was defined to be a full-time farm operator less than 65 years of age whose gross farm sales in 1972 were less than $5,000. Data for the study were taken from a survey of 102 farmers in Jackson, Lee, Owsley, and Wolfe counties.

Farms in the survey were small and the operators poorly educated. The average operator owned 81 acres of farmland and rented an additional 24 acres. Of the 105 acres operated, over half (65 percent) was woodland. These factors impose fairly obvious limits on incomes if land expansion is not allowed.

The analytical results indicate that it is possible for operators of these farms to improve their net incomes substantially. Increases from 1972 incomes of about $2,000 to as much as $6,500 appear to be possible under some assumed conditions. The maximum improvement is possible when the farms emphasize labor-intensive crops (tobacco, cucumbers, and peppers), using improved technology and with no nonmarket limitations on the amount of capital borrowed. Some of these factors are under control of farmers themselves, but many are not. For example, present regulations on the use of tobacco allotments limit expansion of tobacco production; in the absence of an intensive educational program, improving the technology employed may be difficult, especially with older and less well-educated farmers. Advanced age, tradition and limited education present obstacles to change. However, the potential income benefits for even partial adoption of improved technologies and more profitable enterprises are relatively large. Thus, for some of those with substandard family incomes, public investments in the improvement of their farming systems may yield greater improvements in economic welfare than similar expenditures for direct financial aid. These possibilities need to be explored in greater depth, probably through experimental or pilot technical assistance programs.

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APPENDIX TABLE 1

Linear programming tableau, animal-power farm, existing technology

	Tobacco on Bottom ld. (E1)	Tobacco on Rotation ld. (E2)	Tobacco on Shares (E3)	Corn on Bottom ld. (E4)	Corn/ Hay (E5)	Cucumbers (E6)	Peppers (E7)
Net Returns (dollars)	1,391	1,012	740	-39	-20	471	272
Land Resources (acres)							
Bottom land	1	--	--	1	--	1	1
Rotation land	--	1	--	--	1	--	--
Pasture land	--	--	--	--	--	--	--
Family Labor (hours)							
January-March	33	25	33	2	1	--	--
April-May	61	46	61	13	5	20	40
June-July	71	53	71	8	6	200	15
August	58	44	58	--	--	80	40
September	28	21	28	--	--	--	35
October-December	120	90	120	7	2	--	10
Hired Labor (hours)							
April-May	--	--	--	--	--	--	--
June-July	--	--	--	--	--	--	--
August	--	--	--	--	--	--	--
October-December	--	--	--	--	--	--	--
Capital (dollars)							
Operating	158	118	52	32	18	29	45
Animal	--	--	--	--	--	--	--
Building	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--
Tobacco Resources (pounds)							
Owned allotment	2,215	1,619	--	--	--	--	--
Leased allotment	--	--	--	--	--	--	--
Barn space	2,215	1,619	--	--	--	--	--
Share lease	--	--	2,159	--	--	--	--
Accounting Row							
Corn supply (bushels)	--	--	--	-57	-19	--	--
Hay supply (tons)	--	--	--	--	-0.75	--	--
Pasture supply (tons hay equiv.)	--	--	--	--	--	--	--

APPENDIX TABLE 1 (Continued)

	Cucumber/ Hay (E8)	Pepper/ Hay (E9)	Hay on Rotation Land (E10)	Hay on Pasture (E11)	Pasture (E12)	Dairy (E13)	Feeder Pigs (E14)
Net Returns (dollars)	149	81	-23	-23	-8	233	114
Land Resources (acres)							
Bottom land	—	—	—	—	—	—	—
Rotation land	1	1	1	—	—	—	—
Pasture land	—	—	—	1	1	—	—
Family Labor (hours)							
January-March	—	—	—	—	—	30	6
April-May	7	14	2	2	—	14	4
June-July	70	8	9	9	5	14	4
August	27	13	—	—	5	6	2
September	—	12	—	—	—	6	2
October-December	—	3	—	—	—	30	6
Hired Labor (hours)							
April-May	—	—	—	—	—	—	—
June-July	—	—	—	—	—	—	—
August	—	—	—	—	—	—	—
October-December	—	—	—	—	—	—	—
Capital (dollars)							
Operating	17	23	23	23	8	20	25
Animal	—	—	—	—	—	188	92
Building	—	—	—	—	—	100	50
Total	—	—	—	—	—	—	—
Tobacco Resources (pounds)							
Owned allotment	—	—	—	—	—	—	—
Leased allotment	—	—	—	—	—	—	—
Barn space	—	—	—	—	—	—	—
Share lease	—	—	—	—	—	—	—
Accounting Rows							
Corn supply (bushels)	—	—	—	—	—	—	59
Hay supply (tons)	-0.70	-0.70	-2.25	-2.25	—	2.5	—
Pasture supply (tons hay equiv.)	—	—	—	—	-2.0	3.0	0.4

APPENDIX TABLE 1 (Continued)

	Feeder Calf (E15)	Buy Hay (E16)	Sell Hay (E17)	Buy Corn (E18)	Sell Corn (E19)
Net Returns (dollars)	133	-32	32	-1.43	1.43
Land Resources (acres)					
Bottom land	---	---	---	---	---
Rotation land	---	---	---	---	---
Pasture land	---	---	---	---	---
Family Labor (hours)					
January-March	6	---	---	---	---
April-May	3	---	---	---	---
June-July	---	---	---	---	---
August	---	---	---	---	---
September	---	---	---	---	---
October-December	3	---	---	---	---
Hired Labor (hours)					
April-May	---	---	---	---	---
June-July	---	---	---	---	---
August	---	---	---	---	---
October-December	---	---	---	---	---
Capital (dollars)					
Operating	5	16	---	0.72	---
Animal	150	---	---	---	---
Building	---	---	---	---	---
Total	---	---	---	---	---
Tobacco Resources (pounds)					
Owned allotment	---	---	---	---	---
Leased allotment	---	---	---	---	---
Barn space	---	---	---	---	---
Share lease	---	---	---	---	---
Accounting Rows					
Corn supply (bushels)	12	---	---	-1.0	1.0
Hay supply (tons)	2.0	-1.0	1.0	---	---
Pasture supply (tons hay equiv.)	3.0	---	---	---	---

APPENDIX TABLE 1 (Continued)

	Borrow Capital				
	Operating Capital (E20)	Animal Capital (E21)	Building Capital (E22)	Lease-in Tobacco Allotment (E23)	Build Tobacco Barn (E24)
Net Returns (dollars)	-0.07	-0.07	-0.07	-0.20	---
Land Resources (acres)					
Bottomland	---	---	---	---	---
Rotation land	---	---	---	---	---
Pasture land	---	---	---	---	---
Family Labor (hours)					
January-March	---	---	---	---	---
April-May	---	---	---	---	---
June-July	---	---	---	---	---
August	---	---	---	---	---
September	---	---	---	---	---
October-December	---	---	---	---	---
Hired Labor (hours)					
April-May	---	---	---	---	---
June-July	---	---	---	---	---
August	---	---	---	---	---
October-December	---	---	---	---	---
Capital (dollars)					
Operating	-1.0	---	---	0.20	---
Animal	---	-1.0	---	---	---
Building	---	---	-1.0	---	500
Total	1.0	1.0	1.0	---	---
Tobacco Resources (pounds)					
Owned alltoment	---	---	---	-1.0	---
Leased allotment	---	---	---	1.0	---
Barn space	---	---	---	---	-1,000
Share lease	---	---	---	---	---
Accounting Rows					
Corn supply (bushels)	---	---	---	---	---
Hay supply (tons)	---	---	---	---	---
Pasture supply (tons hay equiv.)	---	---	---	---	---

APPENDIX TABLE 1 (Continued)

	Hire Labor				
	April/May (E25)	June/July (E26)	August (E27)	October/December (E28)	Resources
Net Returns (dollars)	-2.00	-2.00	-2.00	-2.00	---
Land Resources (acres)					
Bottom land	---	---	---	---	4.1
Rotation land	---	---	---	---	2.7
Pasture land	---	---	---	---	8.8
Family Labor (hours)					
January-March	---	---	---	---	428
April-May	-1.0	---	---	---	362
June-July	---	-1.0	---	---	617
August	---	---	-1.0	---	312
September	---	---	---	---	261
October-December	---	---	---	-1.0	433
Hired Labor (hours)					
April-May	1.0	---	---	---	60
June-July	---	1.0	---	---	80
August	---	---	1.0	---	100
October-December	---	---	---	1.0	160
Capital (dollars)					
Operating	---	---	---	---	---
Animal	---	---	---	---	---
Building	---	---	---	---	---
Total	---	---	---	---	---
Tobacco Resources (pounds)					
Owned allotment	---	---	---	---	1,329
Leased allotment	---	---	---	---	---
Barn space	---	---	---	---	1,661
Share lease	---	---	---	---	1,294
Accounting Rows					
Corn supply (bushels)	---	---	---	---	---
Hay supply (tons)	---	---	---	---	---
Pasture supply (tons hay equiv.)	---	---	---	---	---

APPENDIX TABLE 2

Linear programming tableau, tractor-power farm, existing technology[a]

	Tobacco on Bottom ld. (E1)	Tobacco on Rotation ld. (E2)	Tobacco on Shares (E3)	Corn on Bottom ld. (E4)	Corn/ Hay (E5)	Cucumbers (E6)
Net Returns (dollars)	1,383	1,006	721	-55	-30	446
Land Resources (acres)						
Bottom land	1.0	--	--	1.0	--	1.0
Rotation land	--	1.0	--	--	1.0	--
Pasture land	--	--	--	--	--	--
Family Labor (hours)						
January-March	33	25	33	1	1	--
April-May	42	32	42	4	2	5
June-July	71	53	71	2	2	190
August	58	44	58	--	--	80
September	28	21	28	--	--	--
October-December	120	90	120	2	1	--
Hired Labor (hours)						
April-May	--	--	--	--	--	--
June-July	--	--	--	--	--	--
August	--	--	--	--	--	--
October-December	--	--	--	--	--	--
Capital (dollars)						
Operating	164	123	66	42	25	41
Animal	--	--	--	--	--	--
Building	--	--	--	--	--	--
Total	--	--	--	--	--	--
Tobacco Resources (pounds)						
Owned allotment	2,215	1,619	--	--	--	--
Leased allotment	--	--	--	--	--	--
Barn space	2,215	1,619	--	--	--	--
Share lease	--	--	2,159	--	--	--
Accounting Rows						
Corn supply (bushels)	--	--	--	-65	-22	--
Hay supply (tons)	--	--	--	--	-0.7	--
Pasture supply (tons hay equiv.)	--	--	--	--	--	--

[a] This tableau also contains activities E13-E28, which are identical to activities E13-E28 in Appendix Table 1. To conserve space, they are not repeated here.

APPENDIX TABLE 2 (Continued)

	Peppers (E7)	Cucumbers/ Hay (E8)	Peppers/ Hay (E9)	Hay on Rotation ld. (E10)	Hay on Pasture (E11)	Pasture (E12)	Resources
Net Returns (dollars)	247	136	68	-35	-35	-10	—
Land Resources (acres)							
Bottom land	1.0	—	—	—	—	—	4.1
Rotation land	—	1.0	1.0	1.0	—	—	9.3
Pasture land	—	—	—	—	1.0	1.0	18.5
Family Labor (hours)							
January-March	—	—	—	—	—	—	440
April-May	30	2	10	1	1	—	376
June-July	10	65	5	5	5	1	708
August	40	27	13	—	—	1	359
September	35	—	12	—	—	—	265
October-December	10	—	3	—	—	—	445
Hired Labor (hours)							
April-May	—	—	—	—	—	—	60
June-July	—	—	—	—	—	—	80
August	—	—	—	—	—	—	100
October-December	—	—	—	—	—	—	160
Capital (dollars)							
Operating	58	25	31	35	35	10	—
Animal	—	—	—	—	—	—	—
Building	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—
Tobacco Resources (pounds)							
Owned allotment	—	—	—	—	—	—	1,772
Leased allotment	—	—	—	—	—	—	—
Barn space	—	—	—	—	—	—	2,215
Share lease	—	—	—	—	—	—	1,941
Accounting Rows							
Corn supply (bushels)	—	—	—	—	—	—	—
Hay supply (tons)	—	-0.7	-0.7	-2.075	-2.075	—	—
Pasture supply (tons hay equiv.)	—	—	—	—	—	-2.0	—

APPENDIX TABLE 3

Linear programming tableau, animal-power farm, improved technology [a]

	Tobacco on Bottom ld. (E1)	Tobacco on Rotation ld. (E2)	Tobacco on Shares (E3)	Corn on Bottom ld. (E4)	Corn/ Hay (E5)	Cucumbers (E6)	Peppers (E7)
Net Returns (dollars)	1,813	1,202	872	-64	-32	730	456
Land Resources (acres)							
Bottom land	1.0	—	—	1.0	—	1.0	1.0
Rotation land	—	1.0	—	—	1.0	—	—
Pasture land	—	—	—	—	—	—	—
Family Labor (hours)							
January-March	33	25	33	2	1	—	—
April-May	61	46	61	13	5	20	40
June-July	71	53	71	8	6	200	15
August	58	44	58	—	—	80	40
September	28	21	28	—	—	—	35
October-December	120	90	120	7	2	—	10
Hired Labor (hours)							
April-May	—	—	—	—	—	—	—
June-July	—	—	—	—	—	—	—
August	—	—	—	—	—	—	—
October-December	—	—	—	—	—	—	—
Capital (dollars)							
Operating	170	119	50	48	27	22	41
Animal	—	—	—	—	—	—	—
Building	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—
Tobacco Resources (pounds)							
Owned allotment	2,800	1,875	—	—	—	—	—
Leased allotment	—	—	—	—	—	—	—
Barn space	2,800	1,875	—	—	—	—	—
Share lease	—	—	2,500	—	—	—	—
Accounting Rows							
Corn supply (bushels)	—	—	—	-90	-27	—	—
Hay supply (tons)	—	—	—	—	-0.8	—	—
Pasture supply (tons hay equiv.)	—	—	—	—	—	—	—

[a] This tableau also contains activities E16-E28, which are identical to activities E16-E28 in Appendix Table 1. To conserve space, they are not repeated here.

APPENDIX TABLE 3 (Continued)

	Cucumber/ Hay (E8)	Pepper/ Hay (E9)	Hay on Rotation ld. (E10)	Hay on Pasture (E11)	Pasture (E12)
Net Returns (dollars)	232	141	-34	-34	-10
Land Resources (acres)					
Bottom land	---	---	---	---	---
Rotation land	1.0	1.0	1.0	---	---
Pasture land	---	---	---	1.0	1.0
Family Labor (hours)					
January-March	---	---	---	---	---
April-May	7	14	2	2	---
June-July	70	8	9	9	5
August	27	13	---	---	5
September	---	12	---	---	---
October-December	---	3	---	---	---
Hired Labor (hours)					
April-May	---	---	---	---	---
June-July	---	---	---	---	---
August	---	---	---	---	---
October-December	---	---	---	---	---
Capital (dollars)					
Operating	19	25	34	34	10
Animal	---	---	---	---	---
Building	---	---	---	---	---
Total	---	---	---	---	---
Tobacco Resources (pounds)					
Owned allotment	---	---	---	---	---
Leased allotment	---	---	---	---	---
Barn space	---	---	---	---	---
Share lease	---	---	---	---	---
Accounting Rows					
Corn supply (bushels)	---	---	---	---	---
Hay supply (tons)	-0.8	-0.8	-2.5	-2.5	---
Pasture supply (tons hay equiv.)	---	---	---	---	-2

APPENDIX TABLE 3 (Continued)

	Dairy (E13)	Feeder Pigs (E14)	Feeder Calf (E15)	Resources
Net Returns (dollars)	256	129	139	---
Land Resources (acres)				
Bottom land	---	---	---	4.1
Rotation land	---	---	---	2.7
Pasture land	---	---	---	8.8
Family Labor (hours)				
January-March	24	6	5	428
April-May	15	4	2	362
June-July	10	4	1	617
August	4	2	1	312
September	4	2	1	261
October-December	24	6	2	433
Hired Labor (hours)				
April-May	---	---	---	60
June-July	---	---	---	80
August	---	---	---	100
October-December	---	---	---	160
Capital (dollars)				
Operating	54	32	8	---
Animal	408	92	259	---
Building	100	203	---	---
Total	---	---	---	---
Tobacco Resources (pounds)				
Owned allotment	---	---	---	1,329
Leased allotment	---	---	---	---
Barn space	---	---	---	1,661
Share lease	---	---	---	1,294
Accounting Rows				
Corn supply (bushels)	---	43	---	---
Hay supply (tons)	3.1	---	2.0	---
Pasture supply (tons hay equiv.)	3.0	0.4	3.0	---

APPENDIX TABLE 4

Linear programming tableau, tractor-power farm, improved technology[a]

	Tobacco on Bottom ld. (E1)	Tobacco on Rotation ld. (E2)	Tobacco on Shares (E3)	Corn on Bottom ld. (E4)	Corn/ Hay (E5)	Cucumbers (E6)	Peppers (E7)
Net Returns (dollars)	1,793	1,187	852	-73	-39	705	431
Land Resources (acres)							
Bottom land	1.0	—	—	1.0	—	1.0	1.0
Rotation land	—	1.0	—	—	1.0	—	—
Pasture land	—	—	—	—	—	—	—
Family Labor (hours)							
January-March	33	25	33	1	1	—	—
April-May	42	32	42	4	2	5	30
June-July	71	53	71	2	2	190	10
August	58	44	58	—	—	80	40
September	28	21	28	—	—	—	35
October-December	120	90	120	2	1	—	10
Hired Labor (hours)							
April-May	—	—	—	—	—	—	—
June-July	—	—	—	—	—	—	—
August	—	—	—	—	—	—	—
October-December	—	—	—	—	—	—	—
Capital (dollars)							
Operating	185	131	65	55	33	35	53
Animal	—	—	—	—	—	—	—
Building	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—
Tobacco Resources (pounds)							
Owned allotment	2,800	1,875	—	—	—	—	—
Leased allotment	—	—	—	—	—	—	—
Barn space	2,800	1,875	—	—	—	—	—
Share lease	—	—	2,500	—	—	—	—
Accounting Rows							
Corn supply (bushels)	—	—	—	-90	-27	—	—
Hay supply (tons)	—	—	—	—	-0.8	—	—
Pasture supply (tons hay equiv.)	—	—	—	—	—	—	—

[a] This tableau also contains activities E16-E28, which are identical to activities E16-E28 in Appendix Table 1. To conserve space, they are not repeated here.

APPENDIX TABLE 4 (Continued)

	Cucumber/ Hay (E8)	Pepper/ Hay (E9)	Hay on Rotation ld. (E10)	Hay on Pasture (E11)	Pasture (E12)
Net Returns (dollars)	220	128	-46	-46	-12
Land Resources (acres)					
Bottom land	---	---	---	---	---
Rotation land	1.0	1.0	1.0	---	---
Pasture land	---	---	---	1.0	1.0
Family Labor (hours)					
January-March	---	---	---	---	---
April-May	2	10	1	1	---
June-July	65	5	5	5	1
August	27	13	---	---	1
September	---	12	---	---	---
October-December	---	3	---	---	---
Hired Labor (hours)					
April-May	---	---	---	---	---
June-July	---	---	---	---	---
August	---	---	---	---	---
October-December	---	---	---	---	---
	---	---	---	---	---
Capital (dollars)					
Operating	27	33	46	46	12
Animal	---	---	---	---	---
Building	---	---	---	---	---
Total	---	---	---	---	---
	---	---	---	---	---
Tobacco Resources (pounds)					
Owned allotment	---	---	---	---	---
Leased allotment	---	---	---	---	---
Barn space	---	---	---	---	---
Share lease	---	---	---	---	---
	---	---	---	---	---
Accounting Rows					
Corn supply (bushels)	---	---	---	---	---
Hay supply (tons)	-0.8	-0.8	-2.5	-2.5	---
Pasture supply (tons hay equiv.)	---	---	---	---	-2.0

APPENDIX TABLE 4 (Continued)

	Dairy (E13)	Feeder Pigs (E14)	Feeder Calf (E15)	Resources
Net Returns (dollars)	256	129	139	---
Land Resources (acres)				
Bottom land	---	---	---	4.1
Rotation land	---	---	---	9.3
Pasture land	---	---	---	18.5
Family Labor (hours)				
January-March	24	6	5	440
April-May	15	4	2	376
June-July	10	4	1	708
August	4	2	1	359
September	4	2	1	265
October-December	24	6	2	445
Hired Labor (hours)				
April-May	---	---	---	60
June-July	---	---	---	80
August	---	---	---	100
October-December	---	---	---	160
Capital (dollars)				
Operating	54	32	8	---
Animal	408	92	259	---
Building	100	203	---	---
Total	---	---	---	---
Tobacco Resources (pounds)				
Owned allotment	---	---	---	1,772
Leased allotment	---	---	---	---
Barn space	---	---	---	2,215
Share lease	---	---	---	1,941
Accounting Rows				
Corn supply (bushels)	---	43	---	---
Hay supply (tons)	3.1	---	2.0	---
Pasture supply (tons hay equiv.)	3.0	0.4	3.0	---